

REMARKS

This is in response to the Office Action mailed February 13, 2003. The Office Action rejected claims 1-4, 32-40, and 45 under 35 U.S.C. § 102 and rejected claims 4-11, 13-15, 17-19, 21-23, 25-27, 30, 31, and 41-44 under 35 U.S.C. § 112.

Applicant notes that the grounds for rejection of claims 12, 16, 20, 24, 28, 29 were not discussed or entered on the record in the Office Action. Applicants respectfully request that in his next response the Examiner enter those grounds, if any, in the record.

Claim 2 and 4 have been amended, claims 5-45 have been cancelled, and claims 46-55 have been added. Claims 2, 4, and 46-55 remain pending in the application. Reconsideration in light of the amendments and remarks made herein is respectfully requested.

Rejections Under 35 U.S.C. § 102

The Office Action rejected claims 1-4 under 35 U.S.C. § 102(e) as being anticipated by Hirakawa et al (hereinafter "Hirakawa") (Japanese Patent No. 6097358).

The Office Action also rejected claims 4, 32-40, and 45 under 35 U.S.C. § 102(e) as being anticipated by Kasahara et al (hereinafter "Kasahara") (Japanese Patent Publication 2002/0005857 A1).

Applicant traverses this rejection in its entirety.

To more clearly claim that which Applicant considers a novel aspect of the invention, claims 2 and 4 have been amended and claims 1, 3, and 5-45 have been cancelled.

Regarding Claim 2, a plurality of sub-fields each having a different luminance weight are arranged in ascending or descending order of luminance weight. When S denotes the sum of luminance weights of the plurality of sub-fields and R is within the range of 0 to S , a gray level corresponding to R is expressed by selecting sub-fields whose luminance weights, when added together, are closest to R . This image display apparatus is characterized in that “when the plurality of sub-fields are arranged in ascending order of luminance weight with a luminance weight of an “ i ”th sub-field being denoted by W_i , the plurality of sub-fields are given such luminance weights that “ n ” exists where $W_1+W_1+W_2+\dots+W_i+\dots+W_n<W_{n+1}$.

According to this invention, the rate of luminance weight change increases in ascending order of luminance weight. This has the following effect of widening the dynamic range.

Conventionally, the rate of luminance weight change is fixed irrespective of whether the luminance weight is large or small. This being so, if the number of light emission pulses in each sub-field is set high, the maximum luminance increases but the gray-level characteristics in a low gray-level range become insufficient. Meanwhile, if the number of sub-fields is increased to widen the ratio between the minimum number of light emission pulses and the maximum number of light emission pulses, the dynamic range can be widened. However, increasing the number of sub-fields causes a drop in maximum luminance.

According to the invention of Claim 2, the dynamic range can be widened without having to increase the number of sub-fields.

Which is to say, in the low gray-level range where a finer gray level resolution is required, luminance weights are fixed at relatively small values to maintain favorable gray-level characteristics in low luminance. On the other hand, in the middle and high gray-level range

where a fine gray level resolution is not required, luminance weights are changed in accordance with the maximum luminance to be reproduced, to thereby increase the maximum luminance significantly.

The present invention aims to widen the dynamic range, whereas *Hirakawa* aims to stabilize the operation when expressing a gray level by a smaller number of addressing operations than the number of sub-fields that constitute one TV field period.

According to Claim 2 a plurality of sub-fields each having a different luminance weight constitute one TV field period. Therefore, the dynamic range can be widened without having to increase the number of sub-fields. On the other hand, *Hirakawa* describes that one TV field period includes a plurality of sub-fields having the same luminance weight (FIG. 3, column 8, lines 1-20). This means there are more sub-fields, which makes it difficult to obtain high luminance.

Regarding Claim 4, a coding pattern which is made up of a combination of sub-fields having predetermined luminance weights is chosen in accordance with the maximum gray level of an input image signal, to express a gray level. When the ratio of the sum of luminance weights of all sub-fields in a first coding pattern to the sum of luminance weights of all sub-fields in a second coding pattern is denoted by a value K where the sub-fields in the first coding pattern are in a one-to-one correspondence with the sub-fields in the second coding pattern in order of luminance weight, the ratios in luminance weight of the sub-fields in the first coding pattern to the corresponding sub-fields in the second coding pattern include a) a ratio is less than or equal to K and b) a ratio greater than K .

According to this invention, in the first coding pattern the degree of increase in luminance is higher than in the second coding pattern.

This makes it possible to select an appropriate dynamic range in accordance with the maximum gray level of the input image signal.

For example, by choosing the second coding pattern when the maximum gray level is low and the first coding pattern when the maximum gray level is high, the degree of increase in luminance can be increased when the maximum gray level of the input image signal is high.

The present invention aims to widen the dynamic range. *Hirakawa* aims to stabilize the operation when expressing a gray level by a smaller number of addressing operations than the number of sub-fields that constitute one TV field period. *Kasahara* aims to reduce pseudo-contour noise.

In the first Office Action, the Examiner states that *Hirakawa* (column 8, lines 1-23) and *Kasahara* (page 12, paragraphs 129 and 135) teach “when a ratio of the sum of luminance weights of all sub-fields in the current TV field period to a sum of luminance weights of all sub-fields in the reference TV field period is denoted by K , the current TV field period includes (a) one or more sub-fields whose luminance weights are obtained by multiplying luminance weights of predetermined sub-fields in the reference TV field period, respectively by coefficients no greater than K , and (b) one ore more sub-fields whose luminance weights are obtained by multiplying luminance weights of predetermined sub-fields in the reference TV field period, respectively by coefficients greater than K ”.

However, the apparatus described by *Hirakawa* does not have the following function. One of a plurality of coding patterns corresponding to a plurality of sub-field combinations is chosen according to the maximum gray level of an input image signal. Here, the plurality of sub-field combinations are such that when sub-fields that constitute one sub-field combination and sub-fields that constitute another sub-field combination are set in a one-to-one correspondence in order of luminance weight, the ratios in luminance weight between the former sub-fields and the latter sub-fields include a ratio no greater than K and a ratio greater than K . Therefore, *Hirakawa* cannot select an appropriate dynamic range according to the maximum gray level of an input image signal.

Kasahara describes that a new sub-field group is created by simply multiplying a luminance weight of each sub-field included in a reference sub-field group (equivalent to a reference coding pattern) by an integer. When the ratios in luminance weight are taken between the sub-fields of the new sub-field group and the sub-fields of the reference sub-field group which are set in a one-to-one correspondence in order of luminance weight, the ratios are uniform.

In more detail, TABLE 1 of *Kasahara* (page 4) shows seven reference sub-field groups and luminance weights of sub-fields in each of these reference sub-field groups, and TABLES 2 to 6 (pages 4 to 5) show new sub-field groups obtained by multiplying the luminance weights of the sub-fields shown in TABLE 1 by integer K . These new sub-fields are, however, simply obtained by multiplying the luminance weights of the corresponding reference sub-fields by uniform integer K . Hence the ratios in luminance weight between the new sub-fields and the reference sub-fields include neither a ratio greater than K nor a ratio less than or equal to K .

Thus, *Kasahara* may change the maximum gray level of an input image signal but cannot change the dynamic range.

For at least the reasons discussed above, Applicant submits that the invention recited in independent Claims 2, 4 and 55 are patentably distinguishable over the cited prior art. Additionally, dependent claims 46-54 are also in condition of allowance as a result of their dependence on claim 4.

Applicants respectfully request that the 35 U.S.C. § 102 rejection be withdrawn.

Rejections Under 35 U.S.C. § 112

The Office Action rejected claims 4-11, 13-15, 17-19, 21-23, 25-27, 30, 31, 41-44 under 35 U.S.C. § 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. In particular, the Office Action noted that claim 4 fails to define the range for the values of K.

Applicants have amended claim 4 such that the value K is a boundary, not a range. The claim now distinguishes between values less than K and values greater than K.

Conclusion

In view of the amendments and remarks made above, it is respectfully submitted that the pending claims are in condition for allowance, and such action is respectfully solicited.

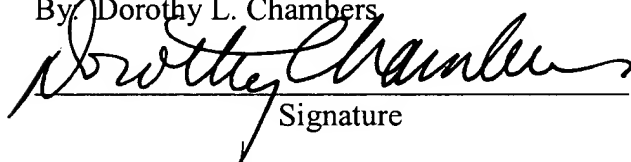
Authorization is hereby given to charge our Deposit Account No. 19-2814 for any charges that may be due. Furthermore, if an extension is required, then Applicants hereby request such an extension.

Respectfully submitted,

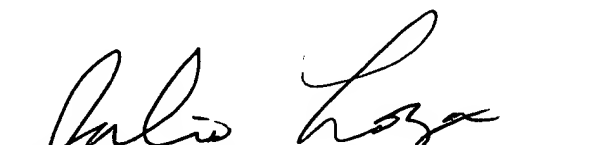
Snell & Wilmer L.L.P.

I hereby certify that this document and fee is being deposited on June 13, 2003 with the U.S. Postal Service as first class mail under 37 C.F.R. §1.8 and is addressed to Commissioner for Patents, P.O. Box 1450, Alexandria VA 22313-1450.

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Signature

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